Progress Report

Grant #731009
Ultra-Efficient Generators & Diesel Electric Propulsion
Genesis Machining & Fabrication
Reporting Dates: 10/2014-12/2014

Deliverables Submitted:

No deliverables at this time – see schedule status.

Budget:

We are invoicing for $11,750.00 in labor and $2,216.82 in materials. We are requesting $15,375.00 in advance for labor and materials for the next quarter. We are submitting $29,102.00 in match.

Schedule Status:

We are behind schedule due to the compounding effects waiting for design software, delays in getting the diesel power unit, and the amount of time spent on printed circuit board design. We have also had to spend some time working on patents, meeting with potential investors, and working on business plans. While all of these activities are directly related to the commercialization of products based on grant research, it has slowed us down significantly. Nevertheless, we have also made good progress!

Work Progress:

1. All printed circuit boards are finally designed and being printed!!!

Boards are finally being printed after nearly a year of working on the printed circuit board design for the TRL-7 inverter. To recap this work: last fall we began working with a group of university students as remote interns and Professor Steven Bitar on the board concept and design. After this we eventually identified Altium as our board design software of choice. After working with the team from Altium we were able to acquire this software at a discount. We designed and built our much-needed battery management system as a first, easy PCB project with Altium. We also acquired our pick-and-place machine to help lower assembly costs, and tested it with our battery management boards. We then tackled the schematic entry and PCB layout of the TRL-7 boards, a process which took about six months. Below are images of the five individual boards which make up the PCB assembly for the TRL-7 inverter module.

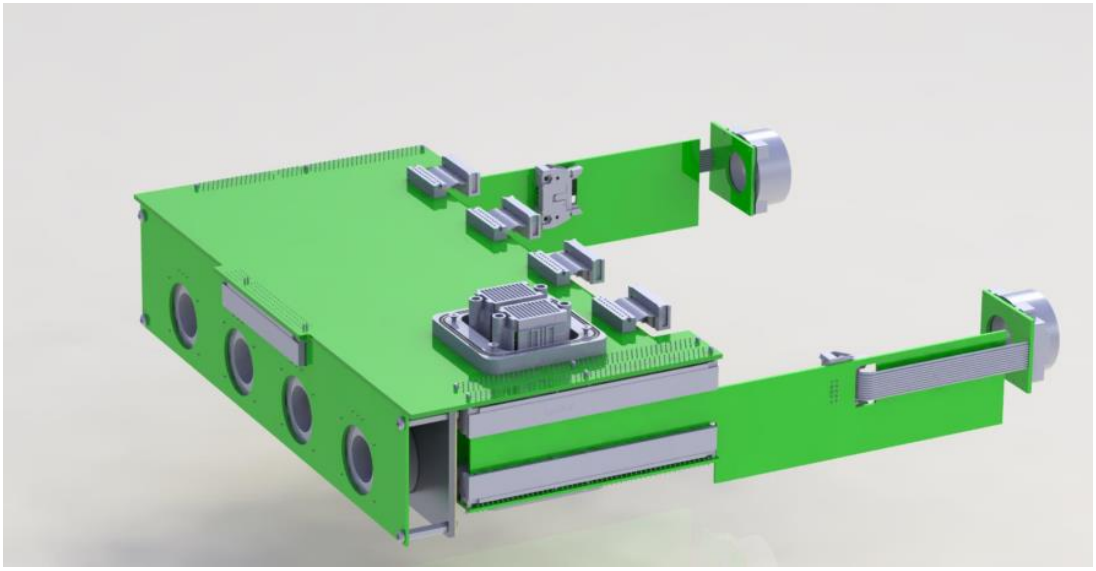

Figure 1 - Rendering of TRL-7 PCB Assembly

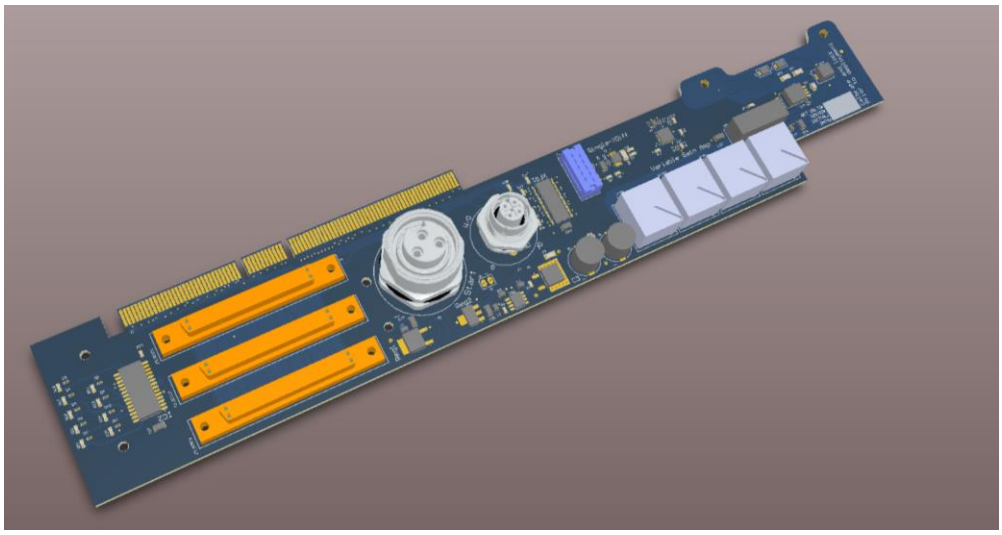

Figure 2 - Layer Interconnect Board

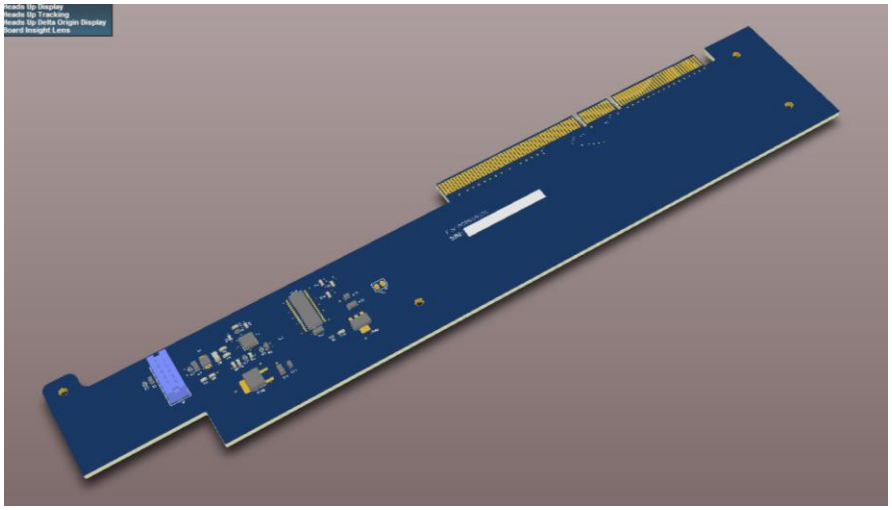

Figure 3 - Negative Side Board

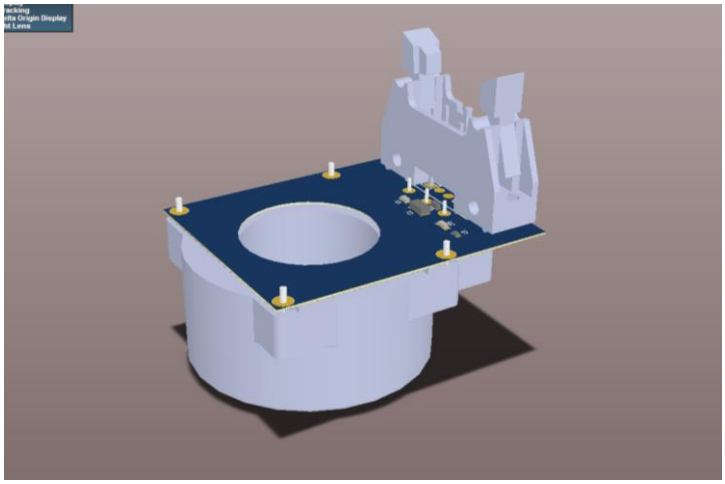

Figure 4 - DC Current Sense Board

Figure 5 - AC Current Sense Board

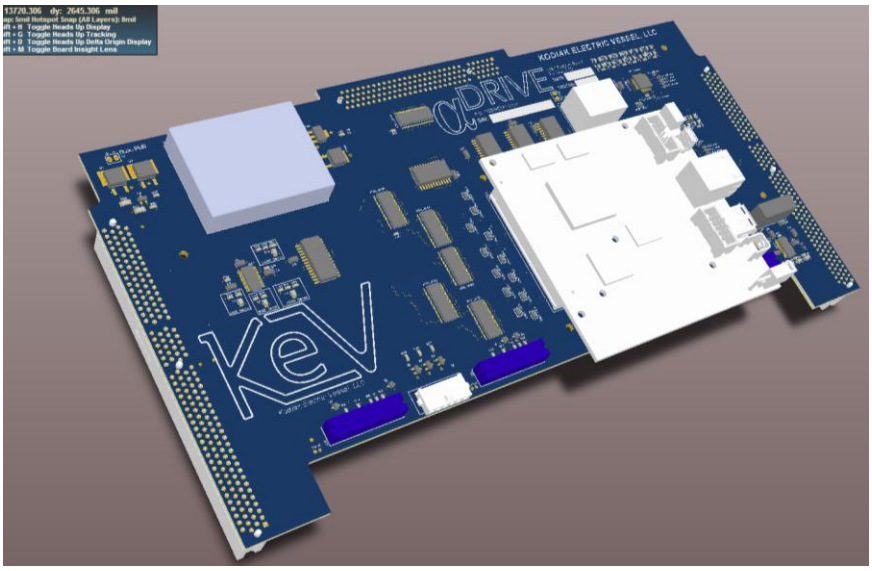

Figure 6 - IGBT Platform Board

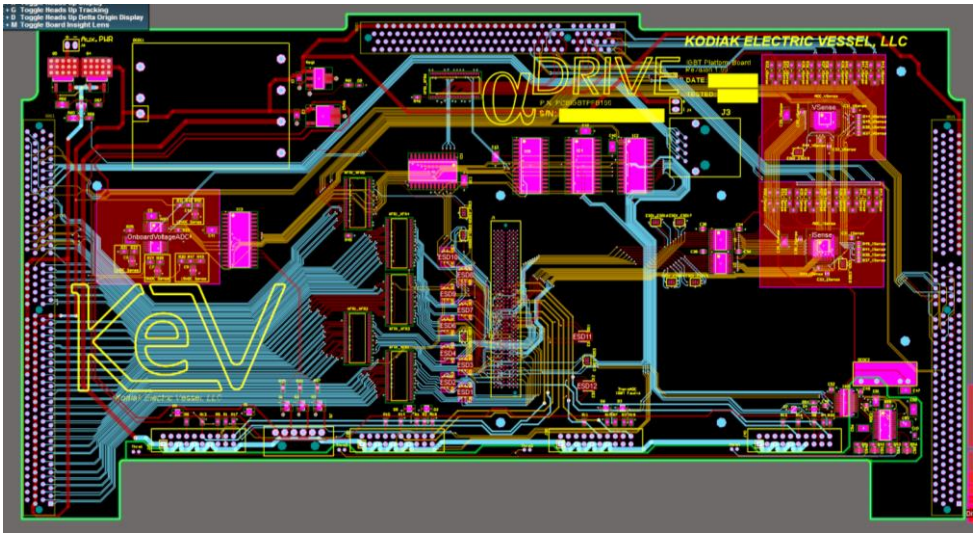

Figure 7 - IGBT Platform Board 2D view

2. Prototyping untested circuits and new Labview Coding

We also prototyped all untested circuits and IC's in the design and coded LabView software to establish communication with the many digital IC's in the design. We confirmed functionality of the digital variable gain amplifiers, ADC's, and GPIO chips present in the design. Here are some photos of our prototyping efforts:

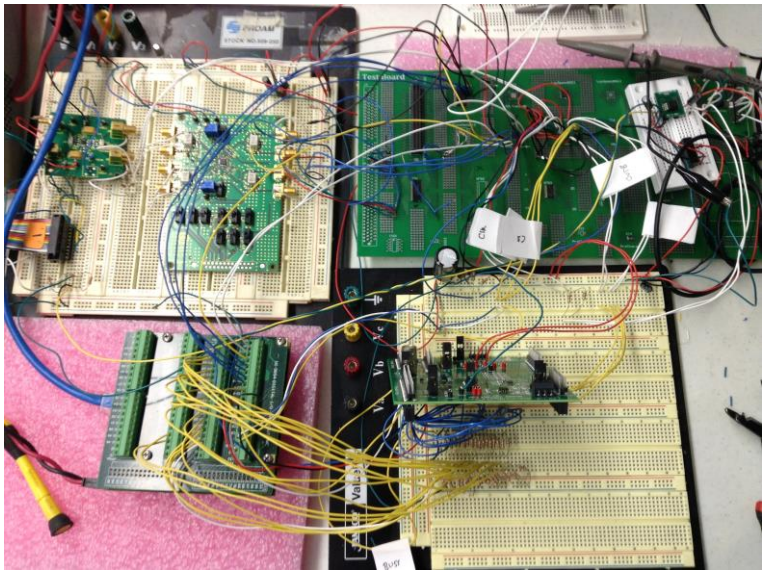

Figure 8 - Prototyping Analog and Digital signal chains

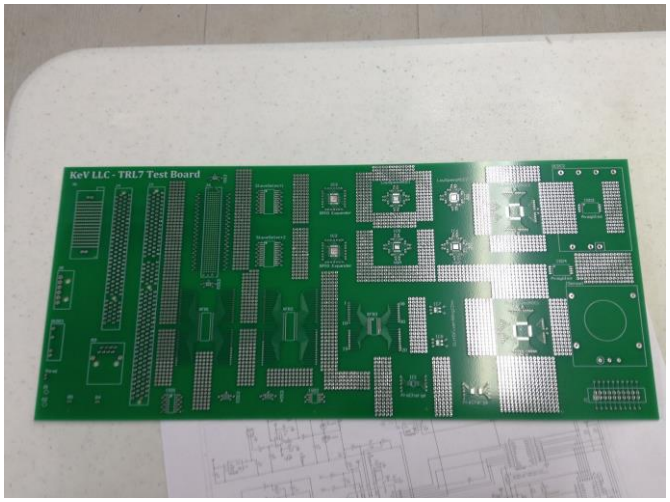

Figure 9 - PCB printed to test IC functionality

3. Intellectual Property

We have one out of three patents now filed. Patents have been written for IP related to variable speed generators, battery management, and inverter architecture.

4. Potential Investors

We made a formal presentation of our technology and market research to an investment group. Once we have some more detail in our business plan, we will meet with them again. The plan is for an initial marine pilot program, followed by further investment to begin manufacturing.

5. Battery Management System

As reported in last quarter, we completed a working TRL-7 version of our battery manager critical for many of the systems we will be commercial deploying. We will also be using the lithium storage system in conjunction with our large 215 kW Variable Speed Generator tests as we explore load starting performance and strategies**. This quarter Seraphim McGann entered the BMS system into the Arctic Innovation Competition held at UAF and took second prize for $5000. This money will be put toward the grant as match.**

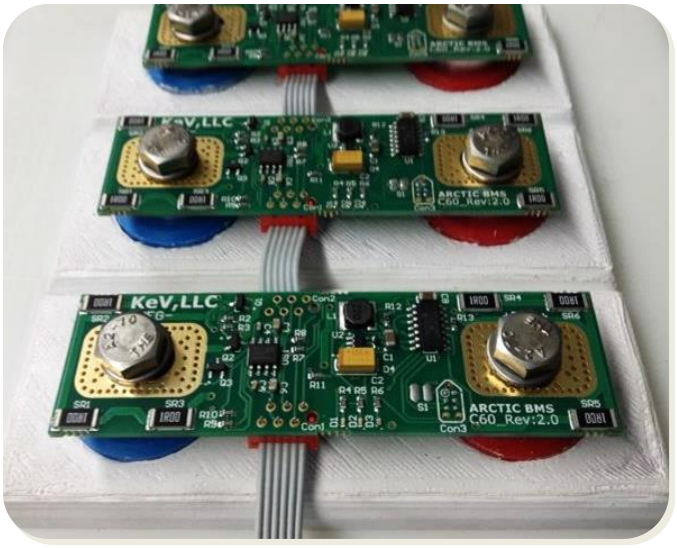

Figure 10 - Arctic BMS installed on test cells

Figure 11 - Seraphim receives the $5K prize!

Work for Next Quarter

1) Assembly and Test TRL-7 PCB's
2) Begin Assembly of TRL-7 hardware components
3) Continue soliciting investment